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Abstract

Despite the rapid development of Internet of Things (IoT) technology, there is still a lack of practical wireless energy monitoring methods that can be implemented directly in rural areas with undeveloped infrastructure. To address this gap, this paper presents a novel far-field wireless electrical load monitoring system. By taking advantage of radio frequency (RF) technology, the system realizes one-point-to-multipoint and multichannel communication, thereby extending the effective communication distance of the system and improving its sustainability to the influence of the external environment. The design proposed in this study includes standby equipment to effectively ensure the normal operation of the system in the case of hardware malfunction. The proposed method can be implemented in most geographical regions, neither confined to specific geographic locations nor limited by the level of development of the local infrastructure. Moreover, the hardware of the proposed system is based on Arduino boards, resulting in a low-cost manufacturing process. This system has been applied in a rural area of Tanzania, with 46 households. This paper reports a 238 % increase in power consumption by the residents between the time of initial system deployment, when they had little access to electricity, and the time when accessibility became easy.

Keywords

Far-field wireless electrical load monitoring; Radio frequency; Sustainability; Low-cost; Rural areas